



AIMSWIS

African Institute for
Mathematical Sciences

WOMEN IN STEM INITIATIVE



New Interventions for a Changing World

**Celebrating African Women Scientists
on the Frontlines of Climate Change**

1st Edition • October 2018

EXCELLENCE • RESPECT • PAN-AFRICANISM • INTEGRITY



Forward from PCEO

Greetings and welcome to our first edition of this publication series, celebrating emerging African women climate scientists.

This publication shares the profiles of emerging women climate scientists who have come through the AIMS ecosystem as AIMS students, AIMS alumni, AIMS Research Fellows and Next Einstein Forum Fellows and Ambassadors.

Through this publication we seek to promote awareness of the valuable contributions that African women can and are making to science, particularly climate science, and promote the incredible stories of female African climate scientists to inspire younger generations of students to pursue STEM careers, including climate science. They serve as important role models.

Climate change is, without a doubt, one of the most significant challenges facing Africa. Increasing temperatures, weather changes including frequent floods and droughts are expected to lead to food insecurity, health epidemics, changes in ecological systems, mass migrations, among other challenges.

Additionally, as we learned from the Gender Summit Africa that we hosted in Kigali in March 2018, African women are and will be disproportionately impacted by climate change. The vast majority of African women depend on subsistence farming for their survival and to supplement their livelihoods. Mass crop failure due to water shortages, pests and changes in soil quality, will not only increase food insecurity and water scarcity, but also intensify social problems that put more women and girls at risk for early marriage, gender-based violence, and other forms of exploitation.

While the challenges before us can be daunting, this publication is a reminder that there is good reason to be hopeful. AIMS is proud to have recently launched the Mathematical Sciences for Climate Resilience program, in collaboration with the governments of Rwanda and Canada, with a focus on accelerating research and scalable solutions to climate resilience, climate mitigation and climate adaption in Africa.

This program, and by extension, this publication, intentionally supports African women climate scientists because AIMS firmly believes that we need Africa's best and brightest minds working on solutions to climate change and we cannot afford to exclude women's unique perspectives, experiences and solutions.

It is my sincere wish that every young girl or woman who reads this publication can see herself and her potential in one of these profiles and that every young boy or man that reads this publication will be reminded of the equal value and potential for scientific excellence of women scientists across the continent.

Thierry Zomahoun

President and CEO, African Institute for Mathematical Sciences (AIMS)

Founder and Chairman, the Next Einstein Forum (NEF)



Introducing AIMS' First Cohort of Women in Climate Change Science Fellows

AIMS believes it is imperative that female researchers are in the driver's seat to contribute to a more sustainable societal response to climate change. 2018 saw the launch of AIMS NEI's Fellowship Program for Women in Climate Change Science. The program will award up to 20 fellowships awarded from 2018 – 2022 to outstanding African women scientists who are applying substantive mathematical science concepts to address pressing climate change issues relevant to Africa.

Beyond a standard fellowship, the Women in Climate Change Science Fellowship addresses barriers women academics often face head on, such as pregnancy, child-birth, and establishing a family. Fellowships include funds allocated for three dependents, affording scientists the opportunity to pursue their research while financially supporting their families. As well, in keeping with the goal of strengthening the capacity of African institutions to respond to climate change, the Fellows must conduct their research at a host institution in Africa, different from their home institution.

In 2018, the first cohort of Climate Change Science Fellows was selected from a competitive pool. Three outstanding scientists were awarded the prestigious fellowship: Dr. Nana Ama Brown Klutse, Dr. Jessica Nosizwe Paula Rose Thorn, and Dr. N'Datchoh Evelyne Touré.



The fellowship program was made possible by a five year grant from the International Development Research Centre, Ottawa, Canada with financial support from the Government of Canada through Global Affairs Canada (GAC). This fellowship program is part of AIMS' broader Mathematical Sciences for Climate Change Resilience (MS4CR) program which seeks to build the intellectual capital needed to solve the myriad challenges to Africa's development resulting from, and impacted by climate change.



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DR. NANA AMA BROWNE KLUTSE **GHANA**

Climate Change Science Fellow, AIMS-NEI 2018

Senior research scientist, Ghana Space Science and Technology Institute, Ghana Atomic Energy Commission

Dr. Klutse is a senior research scientist at the Ghana Space Science and Technology Institute of the Ghana Atomic Energy Commission, where she is the manager of the Remote Sensing and Climate Centre. A climatologist, she has a background in physics and holds a PhD from the University of Cape Town. Her current research focuses on climate modelling and climate impact assessments on society, health, and food security.



Dr. Klutse has worked on national and international projects, including Ghana's climate communication to the United Nations Framework Convention on Climate Change, and the Coordinated Regional Climate Downscaling Experiment (CORDEX). She has co-authored several journal articles and academic books and is lead author of the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.

Dr. Klutse has received several awards and was celebrated as a female icon on Intellectual Property Day 2018, a program by the Registrar General's Department to honour successful women in Ghana.

During the Climate Change Science Fellowship, to be hosted at the Department of Environmental and Geographical Science at the University of Cape Town, South Africa, Dr. Klutse will investigate the dynamics of extreme climate in Africa and the impact of extreme climate under global warming. She hopes that climate science research will be heeded by African governments.

DR. JESSICA NOSIZWE PAULA ROSE THORN **SOUTH AFRICA**

Climate Change Science Fellow, AIMS-NEI 2018

Postdoctoral researcher, Ecosystem Science and Sustainability, Colorado State University / African Climate and Development Initiative, University of Cape Town

Dr. Thorn works to protect essential ecosystem services of importance to humanity, improve resilience to global environmental change, and manage trade-offs between these priorities in smallholder, urban, and mountain systems. She has advised a range of stakeholders in climate adaptation planning in Africa, Asia, and Latin America, including the UN International Strategy on Disaster Risk Reduction, the Red Cross, the World Bank, Conservation International, and the World Wildlife Fund, as well as the governments of Ghana, Kenya, Nepal, and South Africa. Dr. Thorn has co-authored more than 50 journal articles, conference proceedings, reports, manuals, chapters, and science communications. She has received over 20 awards, fellowships, and grants, including the League of European Research Universities, Brettschneider (Cornell), Mind the Environmental Gap (Oxford), and the Marie Skłodowska-Curie Actions Seal of Excellence (European Commission). Dr. Thorn received her MSc and DPhil from Oxford.



Currently, Dr. Thorn is a postdoctoral researcher at Colorado State University, investigating participatory modeling of social-ecological systems. She is an active member of the Global Environmental Facility, contributor to *The Economics of Ecosystems and Biodiversity* reports, and teaches university courses.

Her Climate Change Science Fellowship will combine multi-scalar institutional analysis and ecosystem service quantification with probabilistic modeling to understand synergies and trade-offs of ecosystem-based adaptation in peri-urban areas in Namibia and Tanzania. She hopes this will help advance evidence-based decision-making under uncertainty, improve rural-urban linkages, and increase the participation of the African scientific community in global research programs. During her fellowship tenure, she will be hosted by the African Climate and Development Initiative at the University of Cape Town in South Africa.



DR. N'DATCHOH EVELYNE TOURÉ IVORY COAST

Climate Change Science Fellow, AIMS-NEI 2018

Research Associate, Université Félix Houphouët Boigny, Ivory Coast

Dr. Touré is a research associate at the Université Félix Houphouët Boigny in Ivory Coast. Prior to this position she was a postdoctoral fellow at the Laboratoire d'Aérodologie in Toulouse, France, where she investigated the sources of uncertainties in African biomass inventories and the impact of atmospheric pollution on health in West Africa. Dr. Touré obtained her PhD, which focused on the impact of aerosols from biomass burning and dust on the West African climate, from the Federal University of Technology in Nigeria in 2015. The results showed that aerosols not only impact rainfall distribution but also greatly influence West African monsoon features.

Dr. Touré's current research investigates the potential changes in climate extremes over West and Central Africa at 1.5°C and 2°C global warming using the regional climate model. As a Next Einstein Fellow, her research will assess the impact of climate change on extreme rainfall and temperature patterns over the Ivory Coast in the context of the Paris climate agreement. The results will provide valuable information that can be used by policymakers to formulate mitigation strategies to reduce the impact of climate change on agriculture, human health, and the economy.

During her Climate Change Science Fellowship tenure, Dr. Touré will be hosted by the Competence Centre at the West African Science Service Centre on Climate Change and Adapted Land Use (WASCAL) in Burkina Faso.



Celebrating AIMS Alumni, NEF Ambassadors and NEF Fellows using science to find solutions to address the negative impacts of climate change in Africa

MARIE SOPHIE TSINAMPOIZINA MADAGASCAR

Predicting rainfall patterns using climate modelling

AIMS South Africa (2010)

PhD student, Meteorological Institute, University of Bonn, Germany



Marie Sophie Tsinampoizina joined AIMS South Africa in 2010. She discovered a strong passion for climate modelling during her postgraduate study at AIMS where her thesis focused on the relationship between climate variability over the Indian Ocean and rainfall over northern Madagascar.

Following AIMS, she was sponsored by the WIO-RISE (Western Indian Ocean Regional Initiative in marine Science Education) to pursue an MSc in Ocean and Climate Dynamics at the University of Cape Town in South Africa. For her Master's thesis, she developed a comprehensive study of the rainfall variability over southwestern Madagascar. She reworked her dissertation into a scholarly article in 2015, *Interannual variability of rainfall characteristics over southwestern Madagascar*, which was published in the scientific journal, *Theoretical and Applied Climatology*. Tsinampoizina joined the Regional Initiative in Science Education (RISE) and became part of a network of scientists working to grow local STEM expertise in Africa to stimulate economic development.

In 2016, Tsinampoizina was awarded an International Climate Protection Fellowship from the Alexander von Humboldt Foundation. The initiative gives research grants to host emerging leaders in climate change and biodiversity conservation at research institutions in Germany. With Prof. Dr. Andreas Hense of the University of Bonn, Tsinampoizina has been working on a higher-resolution climate model to produce reanalysis data for Madagascar and its surrounding Indian Ocean. With climate change making weather patterns less predictable, having a more accurate understanding of severe weather events is now more important than ever. Tsinampoizina's project contributes to regional climate services for the Western Indian Ocean, helping to predict rainfall, which is critical to agriculture and remains the main source of livelihoods in the region.

ANDRÉE MENTHO NENKAM CAMEROON

Using mathematical models to help farmers improve their livelihoods

AIMS Ghana (2014)

Scientific Officer (Researcher) International Crop Research Institute for The Semi-Arid Tropics, Mali



Originally from Cameroon, Andrée M. Nenkam joined AIMS Ghana in 2014 with a BSc in mathematics with a minor in computer science from the University of Buea, Cameroon. After graduating from AIMS, Nenkam interned with the African Maths Initiatives (AMI), first in Kenya and then back in Ghana, where she was supervised by the Ghana Meteorological Agency (GMet) under Climate Change, Agriculture and Food Security Project.

In 2015, Nenkam joined the International Crop Research Institute for the Semi-Arid Tropics as a Scientific Officer. Nenkam conducts (i) gridded crop modelling to evaluate the potential of the CCAFS Regional Forecasting toolbox (CRAFT) for yield forecasting in Sub-Saharan Africa assess impact of future climate change on maize agricultural systems in Southern Mali, (ii) capacity building activities of agricultural extension services with the Participatory Integrated Climate Services for Agriculture (PICSA) to improve farmers livelihood and resilience to climate change through the CCAFS funded project titled

"Agriculture is of paramount importance for the economic growth of Africa and it faces multiple challenges as a consequence of the prevalence of climate change and variability with the utmost challenge being food insecurity. In addition, smallholder farmers are the most vulnerable in this picture, therefore integrated activities from public, private and research sectors need to be developed with the aim of creating tailored, useful and usable adaptation packages to improve farmer's resilience to climate change and variability and consequently food security."

Andrée M. Nenkam

"Capacitating African Smallholders with Climate Advisories and Index Insurance Development (CASCAID)". She carried crop/livestock modelling to contribute to the regional (West Africa) integrated assessment of future climate impact on agriculture and inform policies through the program Agricultural Models Inter-Comparison Interchange program (AgMIP).

Nenkam also helps to develop the capacity of national meteorological services to enable them to provide timely, accurate and location specific climate information for extension field staff through the project CASCAID. This project directly contributes to improving farmers' ability to make informed decisions. She has multiple research interests and aspires to carry her PhD in one of the following disciplines: digital soil mapping, farm systems modelling and development of early warning systems, agricultural value chains optimization, big data (remote sensing) and machine learning for precision agriculture. She loves statistics and enjoys computer programming.



CHINENYE ASSUMPTA NNAKENYI NIGERIA

Using ecological modelling to predict the impact of climate change on biodiversity

AIMS South Africa (2015)

PhD Student, Stellenbosch University, South Africa

Nigerian Chinenye Assumpta Nnakenyi completed her first degree (BAHons) in mathematics from the University of Ilorin, Nigeria (2013) before joining AIMS South Africa in 2014.

Nnakenyi then went on to complete a Research Masters Degree in Biomathematics from Stellenbosch University in 2016. She is currently pursuing her Ph.D. in Biomathematics at the Department of Mathematical Sciences, Stellenbosch University.

"Mathematical sciences are indispensable in climate sciences. Because they are useful tools to solve problems through the development of models and analysis of data, which brings understanding of the mechanisms to fight against climate change."

Chinenye Assumpta Nnakenyi

Her research deals with the interplay between mathematics and ecology. She uses mathematical tools and models to understand the ecosystem structure and function amidst numerous anthropogenic perturbations that has caused climate change. Biotic interactions in ecosystem are affected by climate change, causing a reduction in the diversity of species or, in worst cases, extinction of species. Her research aims to find answers to questions, such as what governs the resilience of species to climate change.

She hopes her research will help to mitigate the negative impacts of climate change and improve the adaptation of species by focusing on the stability and complexity of mutualistic species interactions in a meta network. Her work is supervised by Prof C. Hui and Dr H.O Minoarivelo.

Nnakenyi presented her latest research on the "Structural emergence in pollination networks via adaptive interaction switching on Galápagos Islands" at a conference on Models in Population Dynamics and Ecology (MPDE): Global Change in Ecology, Cape Town, South Africa.



WINIFRED AYINPOGBILLA ATIAH GHANA

Using mathematical techniques to predict changes in rainfall extremes

AIMS Senegal (2015)

PhD Candidate in Environmental Physics, Kwame Nkrumah University of Science and Technology KNUST, Ghana

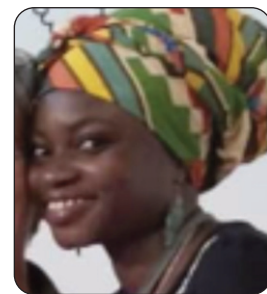
Originally from Ghana, Atiah obtained a bachelor's degree in meteorology and climate science in 2013, and was maintained at the Department of Physics, KNUST as a teaching assistant in 2014.

Atiah joined AIMS Senegal in 2015. Her master's thesis used mathematical techniques (wavelet approach) to analyze the variability of wet and dry spells in rainfall over five regions in the Savannah zones of Ghana.

Atiah will be completing her PhD studies in Environmental Physics in November 2018. She is currently supervised by Prof. Leonard K. Amekudzi at the Kwame Nkrumah University of Science and Technology in Ghana.

Her research focuses on "Performance Assessment of Satellite and DACCIIWA Optical Gauge Rainfall Products and Spatio-temporal Analysis Of Trends And Drivers Of Rainfall Extremes Over Ghana". The current work forms part of the Dynamics-Aerosol-Chemistry-Cloud Interactions in West Africa (DACCIIWA) Project work package.

Atiah enjoyed the field component of the project, which required a hands-on learning on how to set up a weather station, to calibrate various weather instruments and use tools and equipment such as the ceilometer, sun photometer, sodar, radiometer, Micro Rain Radar and many others for measurement. The project has provided her with valued exposure to new collaborations and research teams from Leeds, UK and KIT, Germany. Her research aims to validate satellite rainfall products and to investigate the trends and drivers of rainfall extremes in Ghana. She looks forward to publishing the results of her research soon.



"I have always been motivated to study the atmosphere. Since I was a young girl, I was so fascinated by weather forecasts and many others topics that had to do with the atmosphere."

Winifred Ayinpogbilla Atiah

JEANNETTE MUKAMAHAME GAHUNGA RWANDA

Using statistical models to predict changes in temperature changes

AIMS Cameroon (2017)

Information Technology (IT) Auditor, Ecobank Rwanda

Originally from Rwanda, Jeannette Mukamahame Gahunga obtained a bachelor's degree in computer science from the University of Rwanda. She joined AIMS Cameroon in 2017 as a Mastercard Foundation Scholar, with an interest in climate science.

For her AIMS research, she built a mathematical model and used statistical analysis to predict future temperature changes across three African countries (Cameroon, Zimbabwe and Kenya), using data from the last decade.



"To better understand and eventually combat the negative effects of climate change, the developing societies and growing economies in Africa need to quantify that impact at both individual level as well as society level. It is therefore important to analyse and build a model for the climate change data which will be used to predict what will be the change in the future."

Jeannette Mukamahame Gahunga



DR. SANUSHKA NAIDOO **SOUTH AFRICA**

Harnessing biotechnology to promote increased crop yields

NEF Fellow 2018

Associate Professor, Department of Biochemistry, Genetics and Microbiology, University of Pretoria, South Africa

Dr Naidoo earned a Bachelor's of Science at the University of KwaZulu Natal, where she majored in environmental and cell biology, subsequently specializing in molecular biology for her master's degree at the University of Stellenbosch. Perseverance and passion culminated in a distinction and the gene was patented. She received the Mellon Foundation Mentoring Award to complete her PhD degree in Plant Biotechnology at the University of Pretoria, receiving the award for best PhD paper, presented by the South African Society of Plant Pathologists.

Dr Naidoo is President of the South African Genetics Society (2017-2018) and was awarded a Y-rating by the South African National Research Foundation (2015-2020). Her research is dedicated to plant defense in forest tree species. Dr Naidoo is focusing on mechanisms that can confer broad-spectrum, long lasting resistance by dissecting gene families and responses to pests and pathogens. She has adopted genome editing

technology (CRISPR) to develop plants with desired traits. With the development of new technologies, novel genetically modified crops are poised to increase yield and protect against pests and pathogens under harsh African climates. Dr Naidoo believes we are better equipped to harness this knowledge to address one of Africa's biggest challenge – that of food security.

Dr Naidoo is currently Associate in the Department of Biochemistry, Genetics and Microbiology at the University of Pretoria.

"Africa's youth should study science, technology, engineering and mathematics to discover robust, tangible, natural patterns. Knowledge of such patterns can be harnessed to address the continent's unique challenges."

Dr. Sanushka Naidoo



DR. SHERIEN ELAGROUDY **EGYPT**

NEF Fellow 2018

Associate Professor, Environmental Engineering at Ain Shams University, Egypt

Dr. Sherien Elagroudy, born in Egypt, is an Associate Professor of Environmental Engineering at Ain Shams University in Egypt and the founding director of the first Solid Waste Management Center of Excellence in the country.

She became interested in solid waste during college, when she got involved with a group that was looking to start a campus recycling program. They successfully implemented a program that diverted tons of recyclable materials from landfills to be reused. She felt great satisfaction to be able to have a tangible impact on Egypt's economy and environment. This is what drives her passion today.

Dr. Elagroudy graduated from the Faculty of Engineering at Ain Shams University in Egypt. As the top graduating student that year, she was appointed a teaching assistant at Ain Shams University and then went on to earn her Masters in Science. For her PhD studies at Ryerson University, Dr. Elagroudy modeled the settlement of bioreactor landfills and then built a field-scale prototype of that novel landfill in Cairo. Her new bioreactor stopped methane emissions and the leaching of wastewater into Cairo's water supply. She continued to research novel solid waste treatment systems that could mitigate the environmental impact of waste during a post-doc at Yale University.

Consistent with Dr. Elagroudy's passion to do more than just academic work, she works as a solid waste expert at Chemonics Egypt. She led the team at Chemonics in setting the solid waste management strategy for several countries.

Dr. Elagroudy's work was recognized with the L'Oréal UNESCO Fellowship for Women in Science in 2013 and she was honored as a young scientist at the World Economic Forum in China in 2013. She is a fellow of the Global Young Academy as well as a steering committee member of Egypt's Young Academy of Science.

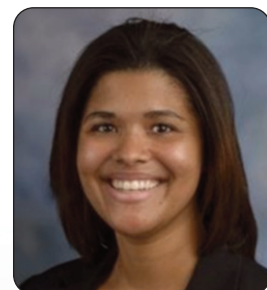
Dr. Elagroudy is currently engaged in several research grants of more than \$3.5 million in the fields of solid waste management, biochemical waste treatment technologies and waste to energy.

DR. LELANI MANNETTI NAMIBIA

Integrating social, ecological and technical systems to devise, analyse and support infrastructure decisions in the face of climatic uncertainty

Former NEF Ambassador, Namibia

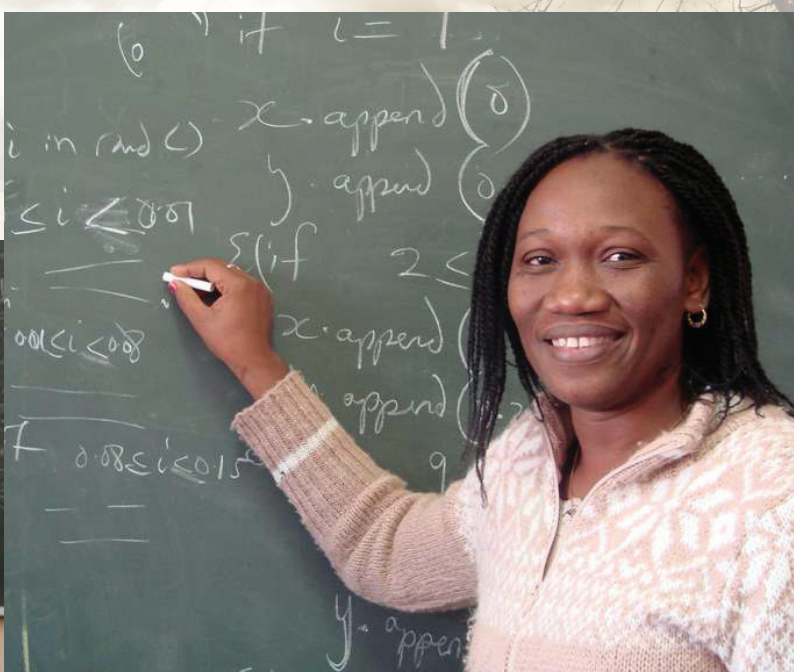
Postdoctoral Research Associate, Urban Studies Institute, Andrew Young School of Policy Studies, Georgia State University, Atlanta.



Currently, Dr. Lelani Mannetti participates in ongoing research at the Urban Resilience to Extremes Sustainability Research Network (UREx SRN). A multi-institutional, transdisciplinary effort, the network aims to develop novel frameworks for integrating social, ecological and technological dimensions in the face of climatic uncertainty. Working alongside David Iwaniec, Dr. Mannetti is developing desirable and plausible scenarios that analyze possible future pathways through which cities can achieve more resiliently designed infrastructures. Their work will promote visionary thinking by city stakeholders to put cities on a path to sustainable futures through accelerated innovative urban sustainability knowledge and application.

With a PhD in Conservation Ecology from Stellenbosch University, South Africa, Dr. Mannetti's previous research focused on the analysis of social-ecological systems, particularly surrounding adaptive co-governance of complex systems. She has conducted social network, stakeholder and institutional analyses in an attempt to include land and resource users' valuation of ecosystem services in protected area decision-making.

Regarding climate change in Africa, Dr. Mannetti has a keen interest in identifying differences among people's values and perceptions on how they respond to extreme events and the implications of these differences. She aims to understand stakeholder preferences and the resulting drivers of change, while identifying viable and sustainable solutions that can inform strategy and decision-making.





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